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September 8, 2000

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
445 12th St., S.W.
Washington, DC 20554

Re: ***Ex Parte* Notification**
ET Docket No. 98-153
Ultra-Wideband

Dear Ms. Salas:

This is to note that on September 7, 2000, Paul Withington, Jeff Ross, Rachel Reinhardt, and Michal Freedhoff of Time Domain Corporation and John Kuzin and I of this firm met with Julius Knapp, Karen Rackley and John Reed of the Office of Engineering and Technology to discuss the testing programs underway in connection with the ultra-wideband proceeding. During the discussions, we distributed the enclosed summaries of Time Domain's comments to NTIA and to the Department of Transportation concerning the testing sponsored by those agencies.

Should any questions arise concerning this matter, please contact me.

Respectfully,

David E. Hilliard

David E. Hilliard
Counsel for Time Domain Corporation

cc: Messrs. Knapp and Reed
Ms. Rackley

Summary of Time Domain Corporation's Comments on the NTIA GPS Test Plan

- Although the purpose of this testing is to evaluate the impact of UWB signals on GPS receivers, the test plan contemplates using a white noise source in conjunction with an UWB signal source. To adequately characterize the sole impact of UWB signals upon GPS, the test plan should include interference testing with a UWB signal source alone.
- The interference measurement procedure described in the test plan is problematic – the allowable noise threshold will be exceeded when any other emitter or noise source is added to the laboratory configuration.
- One of the critical indicators of GPS system performance is the accuracy of position determination. A GPS terminal typically receives at least eight different satellite signals and determines position on the globe by processing at least four of the signals. The NTIA GPS test plan proposes to conduct testing with only a single satellite signal. Collecting additional data using multiple satellites should be realizable given that such a capability is supported by the GPS simulator that NTIA will likely be using.
- The test plan contemplates, at most, only very limited radiated testing. Additional radiated testing is necessary, especially in view of the current debate over how best to quantify the impact of UWB signals. Radiated testing must be used to validate the laboratory configurations and provide feedback to compensate for the many real world effects that cause radiated measurements to differ from those made in the lab environment. Consequently, radiated testing is the only way to assess the true impact of ambient signals, antennas, and multipath interference.
- Radiated testing should include a comparison of the effects of emissions from Part 15 unintentional and incidental radiators that actually radiate into the GPS bands at the Part 15 limits. Such an endeavor will directly answer the critical question of whether there are some characteristics of UWB transmitters that affect GPS in a different manner than the emissions from existing Part 15 devices such as personal computers.
- To the extent that the test plan contemplates synchronizing the transmissions from multiple UWB sources, such a configuration is unrealistic. Time Domain knows of no application that uses simultaneous synchronized UWB transmissions, and such an approach will lead to an improper characterization of aggregate UWB interference.
- The test plan appears to have identified the critical issues with regard to UWB/GPS testing. Time Domain appreciates the effort by NTIA and urges that NTIA keep open the process as it updates the test plan. Time Domain is concerned, however, that the testing not be allowed to slip so as to miss the October 30, 2000, deadline set by the FCC in its *Notice of Proposed Rulemaking* released May 10, 2000.

Summary of Time Domain Corporation's Comments to DOT on Stanford's GPS Test Plan

- The Stanford Plan is fundamentally flawed and will not provide a meaningful assessment of potential interference. The Stanford Plan does not provide for any correlation to real world environments (*e.g.*, ambient noise levels).
- Any GPS test configuration must be verified by "over-the-air" testing. The Stanford Plan contemplates no such testing.
- The Stanford Plan fails to state that the testing will be conducted using a GPS simulator operating with a realistic constellation of satellites. This gives rise to the presumption that the evaluation will examine the effect of UWB on a single satellite signal that will have been adjusted to a received power of less than 4 dB above the thermal noise floor – hardly a realistic scenario. A typical GPS system receives at least eight different satellite signals.
- The Stanford Plan exhibits a clear bias when it notes that any signal margin for UWB has already been consumed by the -70 dBW/MHz out-of-band emissions limit applicable to mobile satellite service (MSS) transceivers. To assess the actual impact of UWB, the plan should consider only the impact of UWB signals on GPS.
- If the susceptibility limits used in the Stanford Plan had any relation to real-world impact, one would expect to find that GPS Systems would already have difficulty operating, as there are a number of other RF systems that are legally permitted to radiate even higher powered signals in the GPS bands than are MSS transceivers.
- The Stanford Plan does not propose to test a signal such as that produced by Time Domain's equipment.
- The Stanford Plan tries to equate all UWB signals with "white" noise. Only some UWB signals can potentially be modeled as broadband white noise.
- The Stanford Plan seeks to cripple the GPS link with high levels of broadband noise, lower the levels, and then add UWB emissions to recreate the same level of interference. A better approach would be to characterize the interference effects from the broadband noise source separately from the UWB signal source, *i.e.*, by testing each source separately.
- The Stanford Plan proposes to subject the white noise signal to filtering prior to injecting it into the GPS receiver, but chooses not to route the UWB signal through the same sort of filter. This unequal filtering technique will likely show a reduced impact of broadband noise as compared to UWB.
- The Stanford Plan offers no justification for its one second reacquisition criterion for land based receivers. One commonly available GPS land receiver specifies a 15-second warm-start acquisition time and a 45-second cold-start acquisition time! In any event, GPS systems are designed to deal with, and do deal with, these situations on a regular basis, and greater than one second reacquisition times are not uncommon.
- In its current form, the Stanford Plan will not yield the sort of information that will assist the FCC in reaching sound decisions concerning the implementation of UWB technology.

Summary of Time Domain Corporation's Comments to NTIA on the Non-GPS Test Plan

- The NTIA test plan presents a high level view of *what* will be examined, rather than detailing *how* it will be examined.
- The plan does not consider existing Part 15 devices and other equipment that generates noise in the relevant spectrum to determine whether UWB creates any additional difficulties. Also, instead of using any "over-the-air" testing, the plans call for tests on a conducted (*i.e.,* physically connected) basis only. Conducted tests will likely provide vastly different results from open air measurements and show interference at much lower, and hence unrealistic, signal levels.
- The goal of the NTIA plan is to determine the susceptibility of critical federal systems to in-band UWB emissions. However, the plan does not specify the protection criteria of established services that will be used to measure the impact of UWB, nor does the plan specify how such criteria have been or will be developed. These critical steps are necessary to quantifying the impact of UWB signal levels and parameters on existing systems.
- The test plan seeks to use the "noise floor" of the victim receiver to find the distance at which UWB systems can operate. *Any* measurable signal in the victim band will be higher than the noise floor.
- To determine the effect of multiple UWB signals, the test plan unrealistically adds three synchronized copies of a single UWB pulse. Because of the path differences from multiple UWB transmitters, a victim receiver would never be presented with three synchronized-in-time pulses. Again, such testing will lead to unrealistic results.
- Because the measurement procedures for UWB signals are still under consideration, the measurement procedures used in the test plan require more detail (*i.e.,* the test equipment make, model, software version) to allow for corroboration of the test results.
- The plan is unclear with regard to the following critical test procedures:
    - Where the plan does contemplate radiated measurements, it does not specify whether the tests will be in a closed anechoic chamber or on an open air test site.
    - The plan fails to include the effect of the antenna beam pattern, which would tend to lessen the effect of UWB transmissions on victim receivers.
    - The plan does not explain how "total peak power" is measured. *See* Table 1, ITS Plan.
    - Measurements made in the time domain must take into account the gains and phase distortions of cables, amplifiers and antennas. The plan does not appear to compensate for this.
- To help regulators develop adequate protection for existing systems, the plan should not begin by assuming that harmful UWB interference will be present. The plan must be designed to quantify the impact of UWB signals on existing systems by finding the acceptable ranges of UWB signal levels and parameters as compared to other Part 15 equipment.